2.0 HIGHWAY CORRIDOR IMPROVEMENT OPTIONS

A review of previous documentation was undertaken to determine the availability of existing engineering conclusions, including the *US 395 Corridor Study* (1995), the *Kootenay Boundary Systems Strategy* (1997), and the *US/Canadian Border Crossing Study* (1999). Each of these documents investigated similar issues (to varying degrees of detail) which are considered in this report. Potential options identified in the above documents were revisited and evaluated based on the objectives of this study.

Previously considered options are summarized as follows:

- **Improve Highway 22/3B (Warfield Hill)**
    a. Truck Arrestor Bed / Runaway Lane in advance of Tennyson Ave
    b. WIM device and VMS signage
    c. Improve Waterhole Corner to reduce loss of uphill traction
    d. Add chain-up area at base of hill
    e. Improve Waterhole Corner runaway lane

  These proposed improvements were detailed in the *Kootenay Boundary Systems Strategy* (1997) report as short-term measures to mitigate safety concerns. At this time, the majority of these improvements have been either investigated or implemented.

- **Warfield By-Pass**
    a. A by-pass from the Teck Cominco entrance on Hwy 22 to the Waterhole Corner would be built to reduce the safety concerns through Warfield.

  This option was not recommended in the *Kootenay Boundary Systems Strategy* (1997) report since it would not significantly reduce operating costs and would not remove trucks from downtown Rossland. In addition, costs related to environmental mitigation were expected to be relatively high.

- **Improve Existing Trail – Waneta Corridor (Hwy 3B & 22A)**
    a. Replace Waneta Bridge
    b. Upgrade Waneta / Boundary Customs Facilities
    c. Increase Capacity on Hwy 3B through Trail (left turn lanes, signal optimization, etc...)

  This option was recommended in the *Kootenay Boundary Systems Strategy* (1997) report subject to the cooperation of the WSDOT in the improvement/upgrading of the Northport-Boundary Road (old SR 251). Any highway improvement to 22A would require the replacement of the Waneta Bridge over the Pend Oreille River. This bridge is currently the oldest bridge in British Columbia and is near the end of its serviceable life.

In addition, its current configuration allows only one lane of traffic and is therefore not suitable for supporting increased volumes of commercial traffic.

- **Improve Waneta – Northport Corridor (Northport-Boundary Road)**
    a. Upgrade county road to accommodate commercial truck traffic (Principal Arterial Design Standards)
    b. Replace/Realign existing bridge over Deep Creek

These improvements were recommended in conjunction with the Hwy 3B & 22A improvements described in the *Kootenay Boundary Systems Strategy* (1997) report. Additionally, both the *US 395 Corridor Study* (1995) and the US/*Canadian Border Crossing Study* (1999) recommended that an improved Northport-Waneta corridor be further studied. The existing cross section along the Northport-Boundary Road is quite narrow and contains several sub-standard curves. At this time vehicles over 40 ft (12 m) are prohibited from this route, for this reason any proposed use of this corridor would require the upgrading of the road to State standards.

- **SR 25 Improvements**
    a. Improve Existing SR 25 (improve geometry, alignment, widen shoulders etc...)
    b. Possibly including a Kettle Falls By-Pass

While the *US 395 Corridor Study* (1995) recommended that the current 395 designation remain as it is, it recognized that significant truck traffic uses SR 25. It recommended that further study be conducted into the viability of upgrading SR 25 to Principal Arterial Design Standards along with the Northport-Boundary Road.

- **Williams Lake Road**
    a. Upgrade to State Principal Arterial Standard
    b. Some improvements may be required
    c. Significant local resident opposition

It was noted in the *US 395 Corridor Study* (1995) that this route is already used by both passenger car and truck traffic due to its travel time and fuel savings as compared to using SR 25 through Kettle Falls.

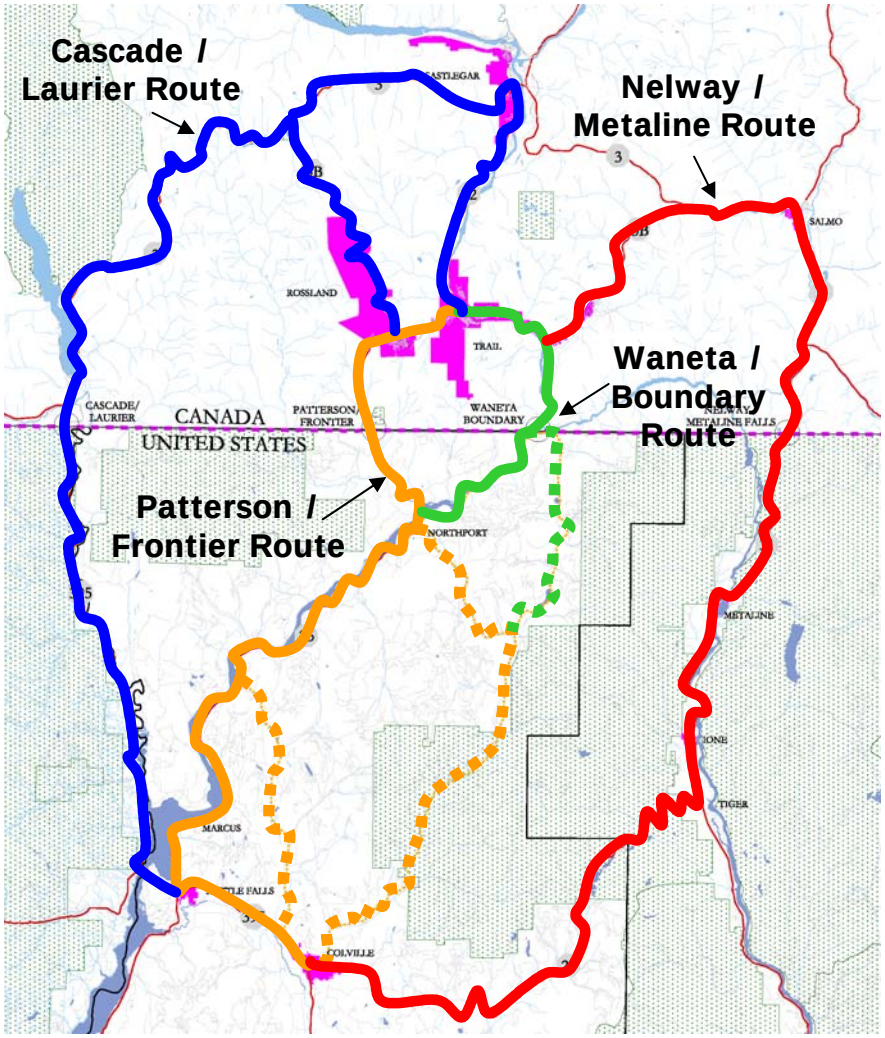
- **Aladdin & Deep Lake – Boundary Road**
    a. Upgrade to State Principal Arterial Standard

This option was found to be the least desirable of any potential north-south routes studied in the *US 395 Corridor Study* (1995). Due to the length of the route (~ 68km) and the presence of significant wetlands along the corridor, costs were expected to make any improvements prohibitive.

2.1 Preliminary Options

A number of preliminary highway corridor options are identified in **Figure 42** and described in the ensuing sections, which, if improved, could form the basis for a corridor improvement scenario to address the issues identified in Section 1.3.

Figure 42: Existing North-South Corridors



2.1.1 Patterson / Frontier Route

US 395 and SR 25 in Washington State and Highways 22 and 3B in British Columbia, comprise the primary existing corridor between the Trail, BC and the Colville, WA regions. This corridor will be considered as the "base case" to which all other improvement options will be compared. Using methods described in the Highway Capacity Manual

(HCM 2000 – Chapter 20, Two-Lane Rural Highways) an estimated average travel speed and time was calculated for this corridor. Taking into account such factors as terrain, percentage of trucks, passing opportunities, and traffic volume the average travel time for all vehicle types was estimated to be 1 hour and 33 minutes. This route includes the Warfield Hill (approximately 10 km between Trail and Rossland), which contains consistent grades between 8-10%.The route climbs to a maximum elevation of 1,070 m (or 3,510 ft) above Trail, BC, as identified in **Figure 43**.

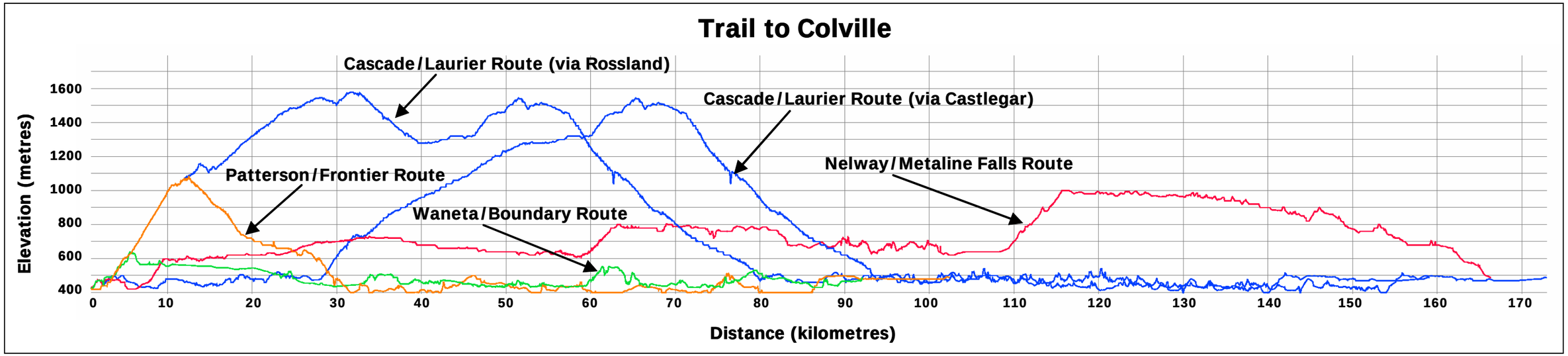
2.1.2 Cascade / Laurier Route

As an alternative to the Patterson/Frontier route this route passes to the west across to the Cascade / Laurier border crossing. This route makes use of the existing US 395 corridor between Colville and the international border. From here Highway 3 is used until passing either through Castlegar and Highway 22 or Rossland along Highway 3B. In comparison to the base case (via Patterson/Frontier) this route has significantly increased travel time and elevation. Using the same HCM 2000 method described above the average travel time for all vehicles was estimated to be 2 hours 54 minutes via Rossland or 3 hours and 15 minutes via Castlegar. The route climbs to a maximum elevation of 1,570 m (or 5,151 ft), as identified in **Figure 43**.

2.1.3 Nelway / Metaline Falls Route

Another alternative route was considered to the east using SR 20 and SR 31 from Colville to the international border at Nelway, BC and Metaline Falls, WA. From the border Hwy 6, Hwy 3, and Hwy 3B is used through Salmo and into Trail. While this route does not have the high elevations of the previous option, there are sections of significant grades in particular along SR 20 near SR 31. Using the HCM 2000 method described above the average travel time for all vehicles was estimated to be 2 hours and 44 minutes.

Figure 43: Preliminary Options – Vertical Profiles



2.1.4 Waneta / Boundary Route

An alternate route following the Columbia River to the East of Trail, BC was considered. From Trail this route uses Hwy 3B and Hwy 22A to the international border at Waneta, BC and Boundary, WA. From the border the Northport-Boundary Road leads to Northport, WA where the route continues onto SR 25. For the purposes of this preliminary screening this route also considered the use of Williams Lake Road as an alternative to continuing down SR 25 via Kettle Falls. In this case, the average travel time for all vehicles was estimated to be 1 hour and 21 minutes using the HCM 2000 methods. There are factors limiting this routes potential use by truck traffic such as the Waneta Bridge and truck restrictions on the Northport-Boundary Road. Several refined improvement options were considered for this corridor and are summarized in the following chapter.

2.2 Preliminary Candidate Screening

The stated goal of this exercise is to broadly investigate opportunities to enhance highway corridor performance between the West Kootenay Region and Northeast Washington in support of increased cross-border trade and tourism, improved Regional industrial productivity and competitiveness and improved safety. In these terms, any improvement to any of the highway corridors noted will meet these goals.

More specific and relevant to the evaluation of options and the decision making process, the objectives of this exercise are stated as:

- Enhanced travel time between the Trail/Castlegar Economic Development Region and the Colville/US 395 area
- Reduced vehicle operating costs between the Trail/Castlegar Economic Development Region and the Colville/US 395 area

Improvement options that do not work towards satisfying these three basic criteria will not meet the objectives of this exercise. In this regard, a preliminary screening exercise has been undertaken on the broad corridor level options and the results are presented in **Table 7**.

Table 7: Preliminary Screening Results

Corridor Option	Travel Time Objective	Vehicle Operating Objective	Status of Option
Patterson/Frontier Route Hwy22,Hwy3B,SR25,US395 BASE CASE	1.5 Hours	+ 650 m + 2100 ft Elevation Gain	BASE CASE
Cascade/Laurier Route Hwy3,Hwy3B,US395	2.5 Hours +67%	+ 1200 m + 3940 ft Elevation Gain +85%	Eliminated
Nelway/Metaline Route Hwy3B,Hwy3,Hwy6,SR31,SR20	3.0 Hours +100%	+ 575 m + 1886 ft Elevation Gain -12%	Eliminated
Waneta/Boundary Route Hwy3B,Hwy22A,County Road,SR25,US395	1.3 Hours -13%	+ 425 m + 1395 ft Elevation Gain -35%	Advances

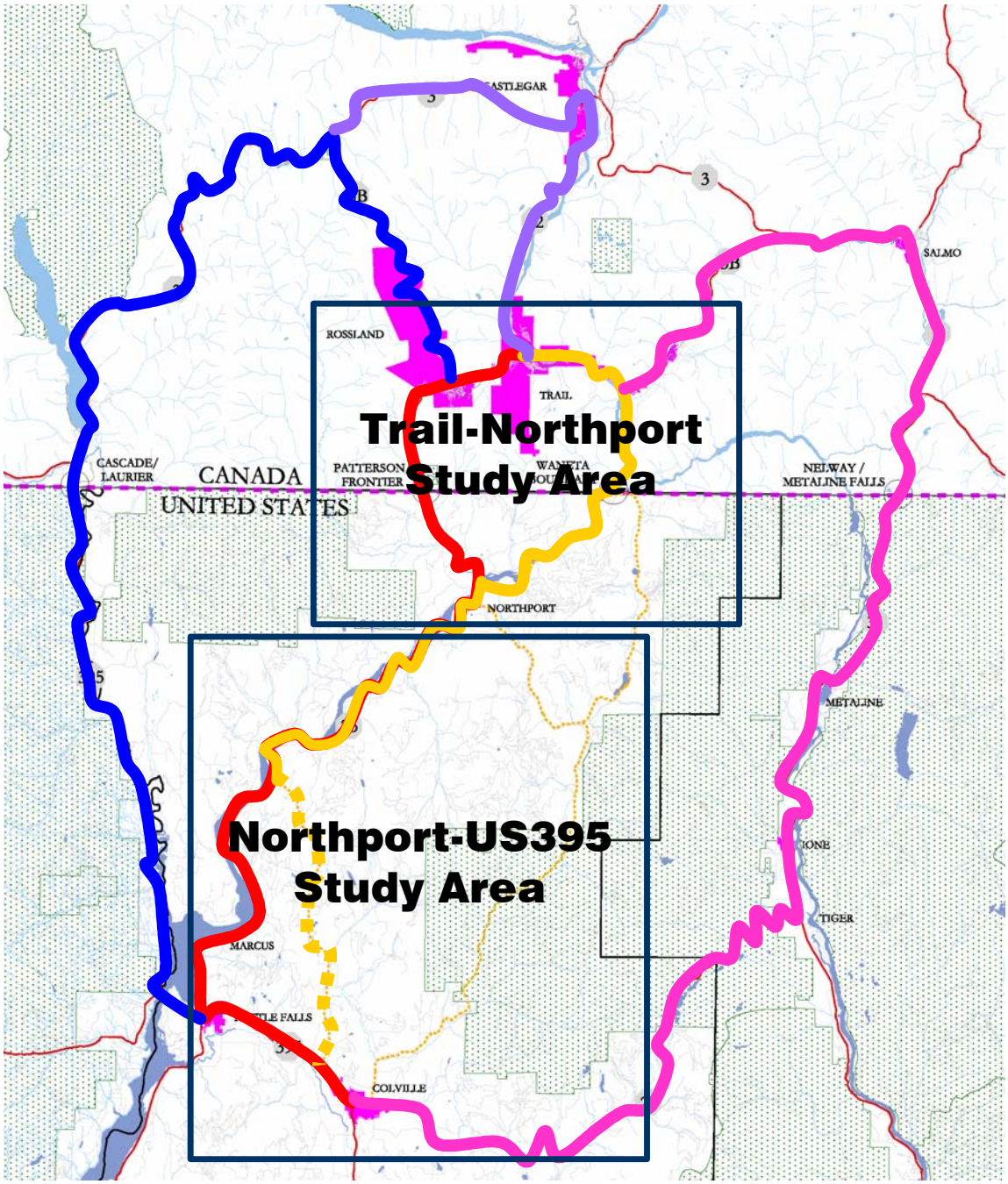
As evidenced in **Table 7**, a preliminary analysis of both the potential for travel time savings and vehicle operating cost savings through vertical grade reductions indicates that both the Cascade/Laurier route and the Nelway/Metaline Falls route do not offer the potential for significant benefit in either category to be considered further. The Cascade/Laurier route traverses both the Nancy Greene Summit as well as the Blueberry-Paulson Summit, introducing significant increases to both travel time and vehicle operating costs, while the Nelway/Metaline Falls route is substantially longer and away from the stated travel 'desire lines' introducing a significant travel time increase. The range of the discrepancy from the base case is so substantial, that no further consideration is given to these candidates in the further stages of evaluation.

The Waneta/Boundary route, using the Hwy 22A, Northport-Boundary Road, SR25 and US 395 corridors, does offer the potential for beneficial performance indices and will form the subject of advanced stages of engineering analysis and comparison. With a travel time benefit potential in the range of 12 minutes averaged over all vehicle classes, and a significant reduction in elevation gain and length (-35%), improvement options in this corridor are the only ones that offer the promise of working toward achieving the objectives.

Given the nature of the corridor topography and designation along its length, in addition to the potential for staging of improvements, options will be considered and compared within the context of two sub-areas. The Northern Sub-Area linking the Trail region to

Northport, and the Southern Sub-Area linking Northport to US 395 (Colville) are illustrated in **Figure 44**.

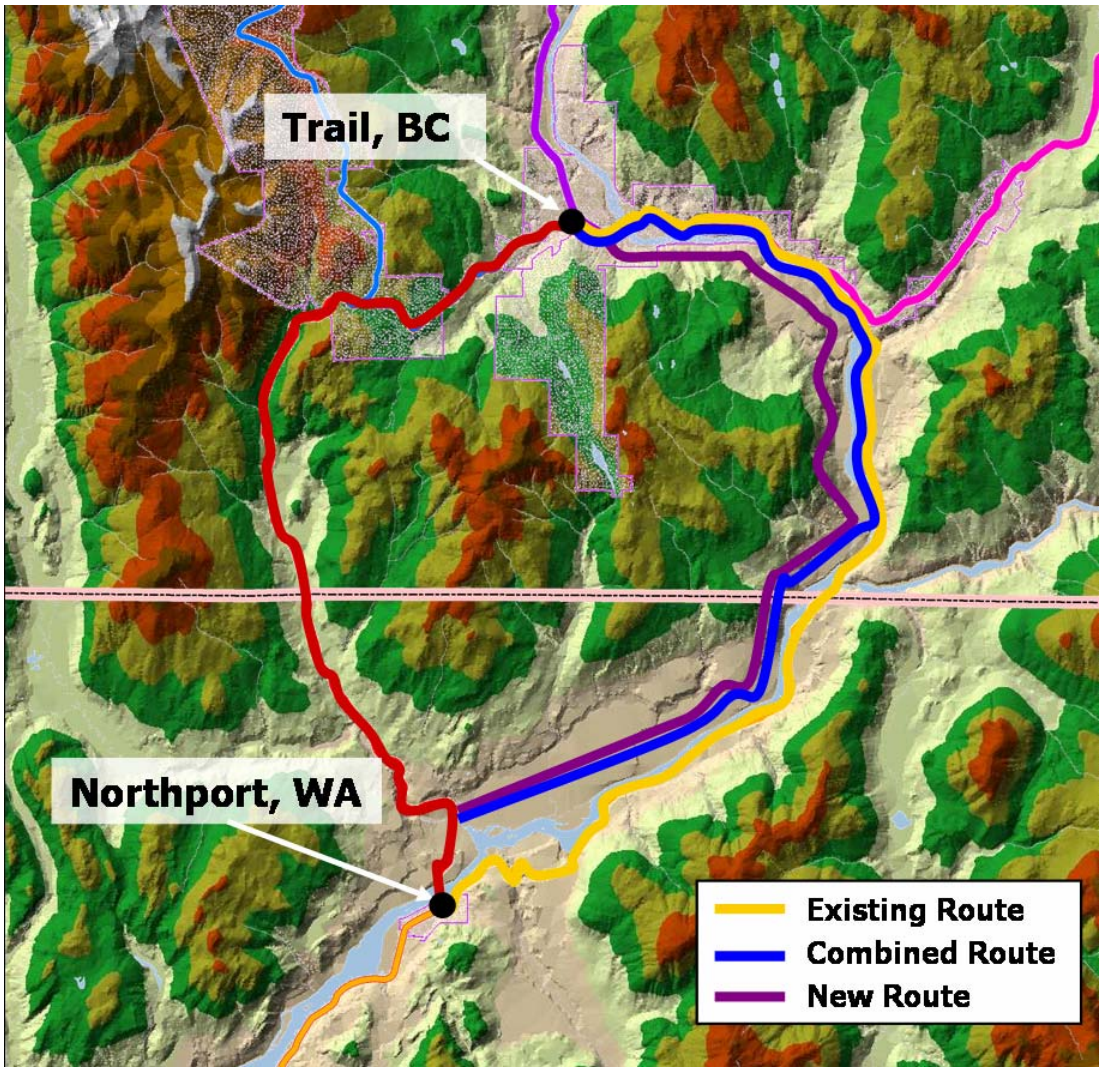
Figure 44: Study Sub-Areas



2.2.1 Northern Sub-Area – Trail, BC to Northport, WA

The northern study sub-area is defined as the segment of the corridor linking Trail, BC to Northport, WA, and is illustrated in **Figure 45** complete with topographical information.

Figure 45: Northern Sub-Area



Three corridor improvement options have been developed within this sub-area, in addition to the base case, aimed at achieving the study objectives. Given the existing and forecast traffic volumes, an all-weather two lane rural highway corridor is envisioned. Due to the mountainous topography of the region potential routes were limited to existing river valleys and mountain passes, any other potential routes are most likely not technically feasible. The options are outlined in the ensuing sub-sections.

2.2.1.1 Existing Route(s) – Hwy 22A & Boundary/Northport Road

This improvement option considers performance, operational and safety related enhancements to the existing corridor comprised of Hwy 22A between Highway 3B and the US Border, and the Stevens County Northport/Boundary Road. Highway 22A is in reasonable condition to support an upgrade to all weather truck route status, and improvements would include shoulder widening and paving, and a new two lane bridge across the Pend Oreille River north of the international boundary. The Northport-Boundary Road, however, would require substantial investment to accommodate a similar upgrade, as the alignment traverses topographically challenging terrain on the east bank of the Columbia River and, while detailed structural condition information was not available, it appears likely that the pavement structure would require upgrading along its entire length. As such, a substantial component of the improvements required would include near complete reconstruction of this segment of the corridor, including a new and substantial bridge crossing of Deep Creek. Examples of Highway 22A and the Northport/Boundary Road are illustrated in **Figures 46 and 47** respectively.

Figure 46: Hwy 22A

Figure 47: Northport/Boundary Road

2.2.1.2 New Route – West Side of Columbia River

This improvement option considers a new all weather corridor along the west bank of the Columbia River, linking Downtown Trail to Northport directly. While the notion of achieving this connection without any new bridge structure was considered, the impacts to Downtown Trail were deemed to be insurmountable (in discussion with the City of Trail) and a new bridge crossing east of the City Centre is considered in this option. The option makes use of the existing SR25 bridge crossing of the Columbia River north of Northport. The alignment traverses rolling and largely undeveloped terrain along the west bank of the Columbia, and could be perceived to open up access to these lands, although significant environmental and archeological impacts would be anticipated. An example of the terrain is illustrated in **Figures 48 and 49**.

Figure 48: West Bank of the Columbia River

Figure 49: West Bank of the Columbia River

2.2.1.3 Combined Route – Hwy 22A & West Side of Columbia River

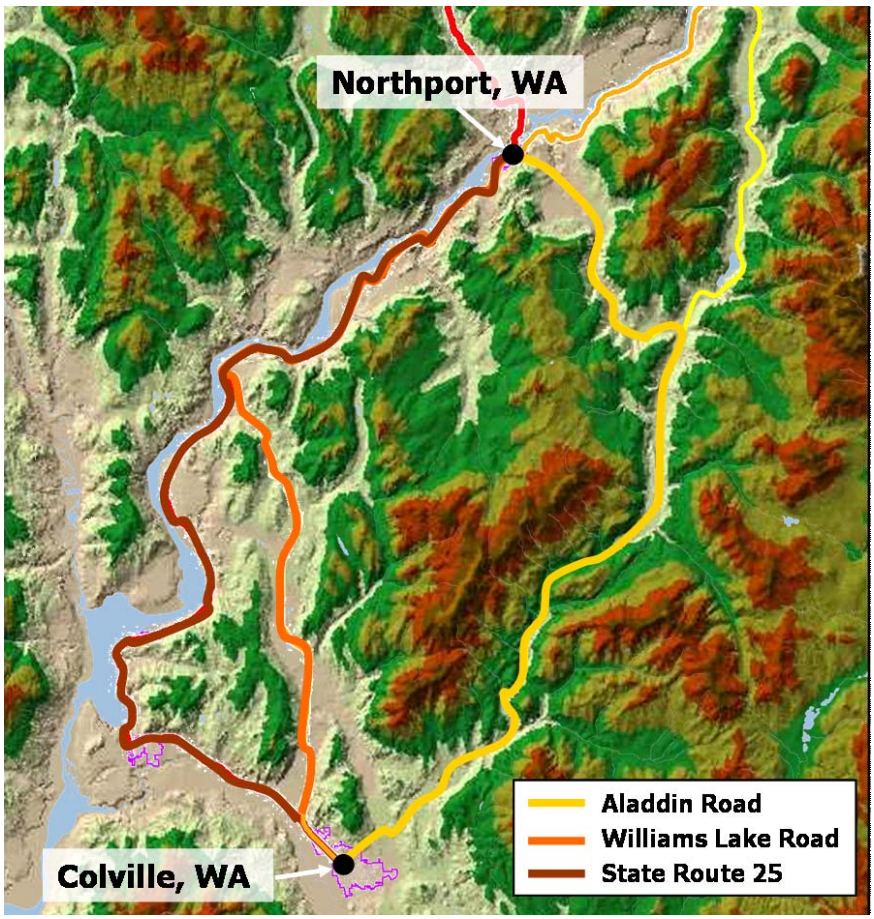
This improvement option considers making use of the existing Hwy 22A facility, a new crossing of the Columbia River north of the international boundary (and replacing the existing crossing of the Pend Oreille on Hwy 22A) and a new facility on the west side of the Columbia River linking across to SR25 north of Northport. It essentially captures the best features of the previous two options.

Given the topography, anticipated level of usage, anticipated cost of construction and environmental impacts, no entirely new corridor options (i.e. new passes through the mountains) have been considered beyond those identified.

2.2.2 Southern Sub-Area

The southern study sub-area is defined as the segment of the corridor linking Northport, WA to US 395 at Colville, WA, and is illustrated in **Figure 50** complete with topographical information.

Figure 50: Southern Sub-Area



2.2.2.1 Existing Route(s) – State Route 25 & US 395

This improvement options considers upgrades to the existing SR25 corridor between Kettle Falls, WA and Northport, WA. The upgrades consist primarily of widening to accommodate paved shoulders and a vehicle recovery area (clear zone) and minor curve and intersection enhancements. While significant truck and commercial traffic currently makes use of the existing SR 25, these improvements were considered in order to facilitate enhanced travel time and reduced vehicle operating costs in keeping with the goals of this study. The existing corridor traverses largely rolling terrain along the east bank of the Columbia River and passes directly through the small communities of Kettle Falls and Northport, WA. Examples of State Route 25 and US 395 are illustrated in **Figures 51 and 52** respectively.

Figure 51: State Route 25

Figure 52: US 395

2.2.2.2 Existing Route(s) - State Route 25 & Williams Lake Road

Similar to the previous option, this considers the use of the Stevens County Williams Lake Road connection between SR 25 and US 395 to Colville, WA. This corridor offers substantial travel time savings over the Kettle Falls route on SR 25. Improvements required are largely in the form of widening to accommodate paved shoulders and vehicle recovery area (clear zone) as well as pavement structure upgrading along its length. Local resident opposition to the use of the Williams Lake Road corridor are noted. Examples of Williams Lake Road are illustrated in **Figures 53 and 54** respectively.

Figure 53 – Williams Lake Road

Figure 54 – Williams Lake Road

2.2.2.3 New Route – Aladdin Road

This improvement option considers upgrades to Stevens County Aladdin Road, linking Boundary to Colville east of the Columbia River Valley. Aladdin Road would require substantial investment to accommodate this upgrade, as the alignment traverses environmentally sensitive terrain and, while detailed structural condition information was not available, it appears likely that the pavement structure would require upgrading along its entire length. As such, a substantial component of the improvements required would include complete reconstruction of this corridor. Examples of Aladdin Road are illustrated in **Figures 55 and 56** respectively.

Figure 55 – Aladdin Road

Figure 56 – Aladdin Road